AEROJET ROCKETDYNE
Ideas Powering Freedom

7499 Pine Stake Road
Culpeper, VA 22701

Tel: 540-854-2000
Fax: 540-854-2002

November 29, 2016

Via FedEx

Mr. Luis A. Pizarro, Associate Director
Office of Remediation 3 LC20
Land and Chemicals Division
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103

Re: Submittal of the Twenty-sixth (26th) Annual Air Monitoring Report Pursuant to the RCRA Research, Development, and Demonstration (RD&D) Permit for the Aerojet Rocketdyne, Inc., Orange County, Virginia Facility, EPA ID No. VAD981112618

Dear Mr. Pizarro:

Pursuant to the RCRA Research, Development, and Demonstration (RD&D) Permit for the Aerojet Rocketdyne, Inc., Orange County facility, I am submitting the Twenty-sixth (26th) Annual Air Monitoring Report. This report includes thermal treatment events from September 1, 2015 to August 31, 2016. There were four (4) treatment events/burns during the reporting period.

The report summarizes the results of: (1) an air quality review including burn monitoring parameters and statistical evaluation of air monitoring results of selected metals [i.e., aluminum (Al), chromium, (Cr), and lead (Pb)], ammonia (NH3-N), hydrochloric acid (HCl), carbon monoxide (CO), and total suspended particulates (TSP); and (2) a worst case scenario validity evaluation of inputs to the air dispersion modeling and risk assessment.

If you have any questions concerning the annual air monitoring report, please call me at 540-854-2037 or tim.holden@Rocket.com.

Sincerely,

AEROJET ROCKETDYNE, INC.

Timothy E. Holden

Timothy E. Holden
Sr. Manager – Safety, Health & Environment
Principal Investigator

cc: L. Romanchik, VA-DEQ/Waste Division

R. Doucette, VA-DEQ/NRO
B. Schwennesen, Aerojet Rocketdyne
B. Wheatley, Aerojet Rocketdyne
D. Rymph, Aerojet Rocketdyne
C. Meredith, Versar

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November 29, 2016

CERTIFICATION LETTER

Dear Sirs:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

The document certified by this letter is the "26th Annual Air Monitoring Report Pursuant to the RCRA Research, Development, and Demonstration (RD&D) Permit for the Aerojet Rocketdyne, Inc., Orange County, Virginia Facility, EPA ID No. VAD981112618", dated November 29, 2016.

Very Truly Yours,

AEROJET ROCKETDYNE, INC.

B Wheatley 11/29/16
(BRIAN WHEATLEY FOR)
Chris W. Conley
V.P. of Environmental, Health & Safety

AEROJET ROCKETDYNE
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Memo

June 1, 2015

To: Brian Wheatley

From: Chris W. Conley
Vice President, Environmental Health and Safety

Subject: Delegation of Authority

Copies: Brian Sweeney, Chris Cambria, William Hvidsten, Ron Felix, Tom Cadwell, Tim Holden, David Rymph, Ron Sherer, Jan DeMeulenaere

Reference: (a) Memorandum, Chairman of the Board, Aerojet-General Corporation, to President, Aerojet-General Corporation, dated January 7, 1985
(b) Memorandum, Office of the President, Aerojet-General Corporation, to Vice President, Environmental Health and Safety, Aerojet-General Corporation, dated October 21, 2008

Pursuant to the delegation of authority established by reference (a) and (b), authority is further re-delegated to Brian Wheatley to execute all agreements and documents related to permit applications, reports or other information submitted to regulatory agencies on behalf of Aerojet Rocketdyne, Inc. and pertaining to its Environmental, Health and Safety functions at the Orange, VA facility.

This authority does not extend to documents expressly requiring a Aerojet Rocketdyne Holdings, Inc. Corporate Officer's signature and is subject to legal or other reviews and approvals required by Aerojet Rocketdyne Holdings, Inc. and Aerojet Rocketdyne Leadership Media. This supersedes all previous delegations that you may have received relative to signature authority on third party documents.

This authority may be re-delegated subject to such limitations as deemed advisable. Please make all subsequent delegations in duplicate originals, furnishing one to the addressee and one to the Aerojet Rocketdyne Legal Department.

Chris W. Conley
Vice President
Environmental Health and Safety

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TWENTY-SIXTH ANNUAL AIR MONITORING REPORT PURSUANT TO THE RCRA RESEARCH, DEVELOPMENT, AND DEMONSTRATION (RD&D) PERMIT FOR THE AEROJET ROCKETDYNE, INC. ORANGE COUNTY, VIRGINIA FACILITY

EPA ID NO. VAD981112618

NOVEMBER 29, 2016

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TABLE OF CONTENTS

AEROJET ROCKETDYNE
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I. INTRODUCTION

Pursuant to Aerojet Rocketdyne, Inc.'s (Aerojet Rocketdyne's) RCRA Research, Development, and Demonstration (RD&D) permit for the thermal treatment facility at their Orange County, Virginia facility, this twenty-sixth (26th) Annual Air Monitoring Report has been prepared for the period of September 1, 2015 to August 31, 2016. This annual report includes information on four (4) thermal treatment events conducted during this period:

1. Burn 313A September 22, 2015
2. Burn 316A December 8, 2015
3. Burn 319A March 1, 2016
4. Burn 321A May 18, 2016

Note that during the third quarter of the annual reporting period, Aerojet Rocketdyne (AR) did not conduct any thermal treatment events. Burn 323A was scheduled to be conducted on July 20, 2016; however, there was an unplanned ignition event during the loading of some waste solid propellant ingredients into the thermal treatment facility (TTF) that required implementation of AR's RCRA Contingency Plan. AR subsequently applied for and received from VA-DEQ a temporary emergency permit on August 8 to implement emergency control methods for treatment and storage of the untreated solid propellant wastes that remained within the TTF from the incident. AR has treated the majority of the solid propellant wastes from the incident. Treatment of the remaining wastes and cleanup in the affected TTU continue under the emergency permit.

Thermal treatment operations of routine production wastes re-started in early October in another treatment unit within the TTF that was not affected by the incident. With the re-start of routine TTF operations, environmental monitoring in the vicinity of the TTF including air monitoring of burn events conducted under the RCRA RD&D permit also re-started at that time.

This report includes the monitored Inpuff 2.2 parameters, an evaluation of whether the worst-case scenarios as inputs to the risk assessment are valid, and a review of the air quality data for the annual reporting period.

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II. MONITORED INPUFF 2.2 PARAMETERS SUMMARY

Prior to initiating thermal treatment operations, computer modeling using the Inpuff 2.2 dispersion model was conducted based on worst-case assumptions to evaluate peak carbon monoxide concentrations during thermal treatment. During the operational phase, the Inpuff parameters are measured to allow fine tuning of the model should the actual field results not agree with the predicted concentration. This fine tuning of the model could be necessary, because no model has been fully validated for the unique conditions during the open burning of waste propellants and explosives.

As required by the EPA-approved Operational Monitoring Plan (OMP), weight of burn, plume temperature, plume spread (vertical and lateral), plume height, wind speed, wind direction, and burn duration are determined during each thermal treatment event. The PG stability class was determined by vertical and lateral dispersion coefficients as a function of downwind distance and weather categories (Gifford, F.A., Jr. "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion"). The monitored Inpuff 2.2 parameters for each burn and for each thermal treatment unit are shown in Table A-1 of Appendix A.

III. WORST-CASE SCENARIO VALIDITY EVALUATION

A sensitivity analysis was conducted at the request of EPA to determine the Inpuff 2.2 dispersion model input parameters that would represent the worst-case scenarios (ARC, Sept. 7, 1990). The model uses conservative assumptions to determine maximum carbon monoxide concentrations. During thermal treatment operation, air monitoring was conducted to confirm that the worst-case conditions were not exceeded at the facility. To evaluate the validity of the worst-case scenarios, the data collected from the downwind monitoring stations were compared to the predictive output of the Inpuff model. If the downwind carbon monoxide concentrations do not exceed the predicted concentration, the worst-case scenario would be determined to be valid. The comparison of model input parameters representing the worst-case scenario with actual monitoring parameters is shown in Table A-2 of Appendix A.

The maximum carbon monoxide concentration from the actual monitored data was 1.36 parts per million (ppm)(range of 0.48 – 1.36 ppm), which is less than the maximum predicted concentration of 4.75 ppm. The monitored concentrations, as well as the modeled concentrations, did not exceed the Permissible Exposure Limit (PEL) of 50 ppm. Therefore, the worst-case was determined to not pose a risk to human health (Versar, September 15, 1990). Also, because the predicted carbon monoxide

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concentration was not exceeded, the worst-case scenario is deemed valid and no fine tuning of the model is needed.

IV. AIR QUALITY REVIEW

As required by the OMP, air monitoring was conducted at one upwind and three downwind locations during each thermal treatment event. The samples were analyzed for selected metals [i.e., aluminum (Al), chromium (Cr), and lead (Pb)], ammonia (NH_3), carbon monoxide (CO), hydrochloric acid (HCL), and total suspended particulates (TSP). The monitoring results are included in Appendix B. In addition, plume temperature, plume height, and plume spread (lateral and vertical) were measured during each burn. Wind speed, wind direction, and ambient temperature were also measured during the burns. Real time weather monitoring was performed to determine whether conditions were safe to conduct thermal treatment, and to confirm that there were no significant shifts in wind direction during air sampling and the most downwind sampling locations were sampled. A summary of these data is included as Table A-1 of Appendix A.

Volatile Organic Compounds (VOCs) were required to be collected for a minimum of one year under the OMP. Any volatile organic shown to be present in excess of 100 parts per billion (ppb) during the first year would continue to be sampled thereafter. Volatile organics were not detected in excess of 100 ppb during the first year; therefore, they were not monitored following the burn event of April 8, 1992. Hence, VOCs are not included in this annual report.

The downwind locations were compared to the upwind locations to determine whether air quality has been impacted. To evaluate the air monitoring results, a one-tailed t-test (Sokal and Rohlf 1981, p. 231) was used to determine whether the upwind concentration was significantly lower than the mean downwind concentration at the 99 percent confidence level. Results of the statistical evaluation for general chemistry and metals are presented in Appendix B. Sample concentrations below the detection limit are indicated by a "<" notation with the detection limit, and a value of one-half the detection limit was used for the t-test.

The statistical evaluation began with calculating the mean (M) and the standard deviation (S) of the downwind concentrations. The equations used for these calculations were as follows:

$$M = (X1+X2+..Xn)/n$$

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where, X = the downward concentration,
n = the total number of downwind concentrations.
S = Square root of $[\Sigma (Xi - M)^2/n]$

The mean and the standard deviation were then used to determine the sample t-value (ts), as follows:

$$ts = (U-M)/(S*[n+1)/n]^{½})$$

where, U = the upwind concentration

The sample t-value is used in comparison with the critical t-value (tc) to determine if the upwind and the downwind samples are from the same population. If the calculated sample t-value is less than the critical t-value then the upwind and downwind means are found to be not significantly different. To determine the critical t-value, the degree of freedom (df) must be determined as follows:

$$df = n - 1$$

The critical t-values at a 99 percent confidence are as follows:

df	tc
1	31.821
2	6.965

The statistical evaluations of the analytical results for the monitored parameters for each of the four (4) thermal treatment events conducted during this reporting period have indicated that the downwind locations are in the same statistical population as the upwind location, with all downwind results estimated not likely to exceed the background/upwind location or not significant because the constituents were below detection limits, for all monitored parameters. Upon consideration of the weather data collected for each treatment event, it was confirmed that there were no significant shifts in wind direction during air sampling and the most downwind sampling locations were sampled. Because the statistical evaluations for those four thermal treatment events conducted during this reporting period (which consider all three downwind locations) are considered valid, and because those evaluations have indicated that the downwind locations are in the same statistical populations as the upwind locations, Aerojet Rocketdyne believes that the data was conclusive that air quality was not adversely

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impacted for the six thermal treatment events conducted during this period (Burns 313A, 316A, 319A and 321A).

Specific information for each thermal treatment event during the reporting period has been included in the quarterly air monitoring reports previously submitted. Both the general chemistry/metal (monitoring) results and statistical evaluations for all the burn events during this reporting period are included in Appendix B.

REFERENCES

Sensitivity Analysis and Identification of Reasonable Worst-Case Scenario Based on Air Dispersion Modeling for the Atlantic Research Corporation, Orange County, Virginia Facility. ARC. September 7, 1990.

Risk Assessment for the ARC Orange County Facility, Human Health Risk Due to Inhalation of Airborne Contaminants. Versar. September 15, 1990.

Sokal, R.R. and F.J. Rohlf. Biometry. 1981. W.H. Freeman and Company. New York, New York.

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Appendix A

Table A - 1. Monitored Inpuff 2.2 Parameters
Table A - 2. Comparison of Modeling and Monitoring Parameters

Table A.1 Monitored Inpuff 2.2 Parameters, Aerojet Culpeper Facility, Annual Report 2016

	09/22/15		12/08/15		03/01/16		05/18/16	
Parameters	**Burn 313A**		**Burn 316A**		**Burn 319A**		**Burn 321A**	
	TTU 1	TTU 2	TTU 1	TTU 2	TTU 1	TTU 2	TTU 1	TTU 2
Weight of Burn (lbs)	15	1,890	42.5	3,042.5	41	2,651	75.0	4,340
Plume Temperature, max (C)	1,388	1,388	1,363	1,363	1,374	1,374	1,267	1,267
Time Pit Ignited	12:30 PM	12:30 PM	3:30 PM	3:30 PM	12:50 PM	12:50 PM	12:40 PM	12:40 PM
Weather Observation	Overcast	Overcast	Clear	Clear	Clear	Clear	Overcast	Overcast
Ceiling Height (m)	3,350	3,350	5,000	5,000	5,000	5,000	1,525	1,525
Altitude of Sun (degrees)	51.2	51.2	12.3	12.3	44.2	44.2	70.5	70.5
Insolation Class	2	2	2	2	3	3	4	4
Net Radiation Index	1	1	2	2	3	3	0	0
Wind Speed (m/s)	3.22	3.22	1.91	1.91	8.07	8.07	1.50	1.50
Wind Direction (degree from North)	52	52	184	184	189	189	32	32
PG Stability Class	D	D	B	B	D	D	D	D
Ambient Temperature (C)	17.71	17.71	13.11	13.11	17.9	17.9	14.63	14.63
Plume Height (ft)	462.84	462.84	303.92	303.92	389.36	389.36	497.03	497.03
Plume Height (m)	141	141	93	93	119	119	151	151
Top of Plume Angle, degrees	29	29	20	20	25	25	27	27
Top of Plume Angle, Radians	0.50615	0.50615	0.34907	0.34907	0.43633	0.43633	0.47124	0.47124
Width of Plume Angle, degrees	14	14	18	18	27	27	24	24
Width of Plume Angle, Radians	0.24435	0.24435	0.31416	0.31416	0.47124	0.47124	0.41888	0.41888
Width of Plume (m)	62	62	81	81	122	122	126	126
Downwind distance, x (m)	254	254	254	254	254	254	297	297
Downwind distance, x (km)	0.254	0.254	0.254	0.254	0.254	0.254	0.297	0.297
Plume Spread - Lateral (sigma y) (m)	45.0	45.0	29.5	29.5	29.5	29.5	71.2	71.2
Plume Spread - Vertical (sigma z) (m)	25.6	25.6	17.5	17.5	17.5	17.5	45.8	45.8
PG Stability Class - Lateral (sigma y)	B	B	C	C	C	C	B	B
PG Stability Class - Vertical (sigma z)	B	B	C	C	C	C	A	A
Duration of Burn (Hr:Min:Sec)	0:08:00	0:08:00	0:12:00	0:12:00	0:12:00	0:12:00	0:15:00	0:15:00

Notes:
NA - Not Applicable
ND - No Data
PG Stability Classes:
A - Extremely to moderately unstable
B - Moderately unstable
C - Slightly unstable
D - Natural
E - Slightly stable
F - Moderately stable

Table A-2. Comparison of Modeling and Monitoring Parameters, Annual Report 2016

Parameters	INPUFF 2.2 MODEL (far field, near field)	ACTUAL MONITORED CONDITIONS
Carbon Monoxide (ppm)	4.75	0.48 - 1.36
Weight of Burn (lb.)	1000, 7000	1,905 - 4,415
Plume Temperature (C) (Max)	NA	1,267 - 1,388
Ambient Temperature (C)	NA	13.11 - 17.71
Plume Height (m)	50, 60	93 - 151
Plume Spread - Lateral (sigma y) (m)	14, 35	29.5 - 71.2
Plume Spread - Vertical (sigma z) (m)	14, 14	17.5 - 45.8
Wind Speed (m/s)	1 - 4.5	1.50 - 8.07
PG Stability Class	A, B	B, D
Duration of Burn (Min:Sec)	1:00	08:00 - 15:00

Notes:

NA - Not Applicable

A - Extremely to moderately unstable

B - Moderately unstable

C - Slightly unstable

D - Neutral

E - Slightly stable

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Appendix B

GENERAL CHEMISTRY AND METALS RESULTS AND STATISTICAL EVALUATIONS

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AEROJET ROCKETDYNE, INC.
ORANGE COUNTY FACILITY

BURN 313A
SEPTEMBER 22, 2015

December 22, 2015

Mr. Tim Holden
Environmental Manager
Aerojet Corporation
7499 Pine Stake Road
Culpeper, VA 20155

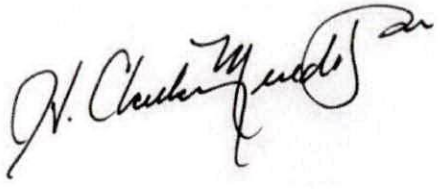
Subject: Burns 313A Statistical Report, Versar Project No. 112133

Dear Mr. Holden:

Enclosed please find General Chemistry Results and Statistical Evaluations for Burn 313A conducted on September 22, 2015. All results were estimated as not likely to exceed background or as not significant because the constituents were not detected (e.g., hydrogen chloride).

Should you have any questions, please do not hesitate to contact me at (703) 642-6842.

Sincerely,



H. Clarkson Meredith, III
Project Manager
Springfield Environmental Services Group

Enclr.

VERSAR

6850 Versar Center
Springfield, VA 22151
703.750.3000
www.versar.com

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 313A - Statistical Evaluation
September 22, 2015

BURN 313A RAW FIELD DATA AND LABORATORY RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/sample)	HCl in air (ug/sample)	Al (ug/sample)	Cr (ug/sample)	Pb (ug/sample)	CO (ppm)	Total Suspended Particulates (TSP) (mg) after	(mg) before	(mg/sample) mass
II-313A	Upwind	2.68	5 <	19.6 <	0.245 <	1.96 <	0.76	4,529.4	4,528.0	1.4
LL-313A	Downwind	5.19	5 <	139.0	0.508	1.95 <	0.82	4,549.2	4,548.2	1.0
CC-313A	Downwind	4.90	5 <	40.9	0.242 <	1.93 <	0.81	4,557.0	4,555.5	1.5
BB-313A	Downwind	11.90	5 <	19.7 <	0.246 <	1.97 <	0.78	4,548.0	4,546.2	1.8

		NH3-N VOLUMES (L)	HCl in air VOLUMES (L)	Metals & TSP VOLUMES (ft^3)	CO Volumes (L)
II-313A	Upwind	18.216	36.234	3,600	8.9946
LL-313A	Downwind	18.234	36.216	3,600	8.9946
CC-313A	Downwind	18.324	36.216	3,600	8.9946
BB-313A	Downwind	18.252	36.180	3,600	8.9964

< - Denotes constituent not detected. Value is the analytical reporting limit.

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 313A - Statistical Evaluation
September 22, 2015

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/m3)		HCl in air (ug/m3)	Al (ug/m3)		Cr (ug/m3)		Pb (ug/m3)	CO (ppm)	TSP (ug/m3)
BURN 313A											
II-313A	Upwind	147.1	<	138.0	0.19	<	0.002	<	0.00963	0.76	13.8
LL-313A	Downwind	284.6	<	138.1	1.37		0.005	<	0.00958	0.82	9.8
CC-313A	Downwind	267.4	<	138.1	0.40	<	0.002	<	0.00948	0.81	14.7
BB-313A	Downwind	652.0	<	138.2	0.19	<	0.002	<	0.00968	0.78	17.7

NOTES:
< = Not detected.

	NH3-N	HCl in air	Al	Cr	Pb	CO	TSP
COUNT:	3	3	3	3	3	3	3
MEAN DOWNWIND CONC.:	401	69.1	0.65	0.00	0.0048	0.803	14.1
STANDARD DEVIATION:	177	0.03	0.51	0.001	0.0001	0.017	3.2
SQRT(N+1/n):	1.15	1.15	1.15	1.15	1.15	1.15	1.15
SAMPLE t VALUE:	1.24	1.53	0.78	0.61	0.2	2.21	0.09
DEGREE OF FREEDOM:	2	2	2	2	2	2	2
CRITICAL t VALUE:	6.965	6.965	6.965	6.965	6.965	6.965	6.965
COMMENTS:	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN

NOTES:
NOT SIGN = Not Significant. Population mean of downwind concentrations likely does not exceed upwind concentrations.
*NOT SIGN = Not Significant. All downwind samples results were below the reporting limit.
SIGNIFICANT = Population mean of downwind concentrations likely exceeds the upwind concentration.

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AEROJET ROCKETDYNE, INC.
ORANGE COUNTY FACILITY

BURN 316A
DECEMBER 8, 2015

March 17, 2016

Mr. Tim Holden
Environmental Manager
Aerojet Corporation
7499 Pine Stake Road
Culpeper, VA 20155

Subject: Burns 316A Statistical Report, Versar Project No. 112133

Dear Mr. Holden:

Enclosed please find General Chemistry Results and Statistical Evaluations for Burn 313A conducted on December 8, 2016. All results were estimated as not likely to exceed background or as not significant because the constituents were not detected (e.g., hydrogen chloride).

Should you have any questions, please do not hesitate to contact me at (703) 642-6842.

Sincerely,

H. Clarkson Meredith, III
Project Manager
Springfield Environmental Services Group

Enclr.

VERSAR

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Springfield, VA 22151
703.750.3000
www.versar.com

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 316A - Statistical Evaluation
December 8, 2015

BURN 316A RAW FIELD DATA AND LABORATORY RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/sample)	HCl in air (ug/sample)	Al (ug/sample)	Cr (ug/sample)	Pb (ug/sample)	CO (ppm)	Total Suspended Particulates (TSP) (mg) after	(mg) before	(mg/sample) mass
CC-316A	Upwind	4.34	5 <	74.8	0.195	1.51 <	0.48	4,570.0	4,569.2	0.8
EE-316A	Downwind	4.54	5 <	82.3	0.264	1.53 <	0.52	4,561.9	4,560.4	1.5
II-316A	Downwind	14.80	5 <	45.1	0.186 <	1.49 <	0.55	4,546.7	4,545.7	1.0
HH-316A	Downwind	17.70	5 <	47.6	0.196	1.52 <	1.36	4,554.6	4,553.6	1.0

		NH3-N VOLUMES (L)	HCl in air VOLUMES (L)	Metals & TSP VOLUMES (ft^3)	CO Volumes (L)
CC-316A	Upwind	18.216	36.234	3,600	8.9946
EE-316A	Downwind	18.234	36.234	3,600	8.9946
II-316A	Downwind	18.324	36.216	3,600	8.9946
HH-316A	Downwind	18.252	36.270	3,600	8.9964

< - Denotes constituent not detected. Value is the analytical reporting limit.

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 316A - Statistical Evaluation
December 8, 2015

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/m3)		HCl in air (ug/m3)	Al (ug/m3)		Cr (ug/m3)		Pb (ug/m3)	CO (ppm)	TSP (ug/m3)
BURN 316A											
CC-316A	Upwind	238.3	<	138.0	0.73		0.002	<	0.00742	0.48	7.9
EE-316A	Downwind	249.0	<	138.0	0.81		0.003	<	0.00752	0.52	14.7
II-316A	Downwind	807.7	<	138.1	0.44	<	0.002	<	0.00732	0.55	9.8
HH-316A	Downwind	969.8	<	137.9	0.47		0.002	<	0.00747	1.36	9.8

NOTES:
< = Not detected.

	NH3-N	HCl in air	Al	Cr	Pb	CO	TSP
COUNT:	3	3	3	3	3	3	3
MEAN DOWNWIND CONC.:	675	69.0	0.57	0.00	0.0037	0.810	11.5
STANDARD DEVIATION:	309	0.04	0.17	0.000	0.0001	0.389	2.3
SQRT(N+1/n):	1.15	1.15	1.15	1.15	1.15	1.15	1.15
SAMPLE t VALUE:	1.23	0.23	0.84	0.51	0.1	0.73	1.35
DEGREE OF FREEDOM:	2	2	2	2	2	2	2
CRITICAL t VALUE:	6.965	6.965	6.965	6.965	6.965	6.965	6.965
COMMENTS:	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN

NOTES:
NOT SIGN = Not Significant. Population mean of downwind concentrations likely does not exceed upwind concentrations.
*NOT SIGN = Not Significant. All downwind samples results were below the reporting limit.
SIGNIFICANT = Population mean of downwind concentrations likely exceeds the upwind concentration.

AEROJET ROCKETDYNE
Ideas Powering Freedom

7499 Pine Stake Road
Culpeper, VA 22701

Tel: 540-854-2000
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AEROJET ROCKETDYNE, INC.
ORANGE COUNTY FACILITY

BURN 319A
MARCH 1, 2016

BURN 321A
MAY 18, 2016

June 24, 2016

Mr. Tim Holden
Environmental Manager
Aerojet Corporation
7499 Pine Stake Road
Culpeper, VA 20155

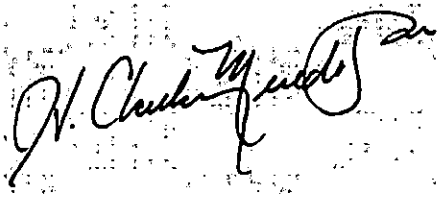
Subject: Burns 319A and 321A Statistical Report, Versar Project No. 112133

Dear Mr. Holden:

Enclosed please find General Chemistry Results and Statistical Evaluations for Burn 319A and Burn 321A conducted on March 1 and May 18, 2016. All results were estimated as not likely to exceed background or as not significant because the constituents were not detected (e.g., hydrogen chloride).

Should you have any questions, please do not hesitate to contact me at (703) 642-6842.

Sincerely,



H. Clarkson Meredith, III
Project Manager
Springfield Environmental Services Group

Enclr.

VERSAR

6850 Versar Center
Springfield, VA 22151
703.750.3000
www.versar.com

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 319A - Statistical Evaluation
March 1, 2016

BURN 319A RAW FIELD DATA AND LABORATORY RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/sample)	HCl in air (ug/sample)	Al (ug/sample)	Cr (ug/sample)	Pb (ug/sample)	CO (ppm)	Total Suspended Particulates (TSP) (mg) after	(mg) before	(mg/sample) mass
DD-319A	Upwind	5.22	5 <	65.2	0.291	1.92 <	0.57	4,555.5	4,553.7	1.8
EE-319A	Downwind	15.10	5 <	77.7	0.282	1.98 <	0.62	4,565.4	4,564.0	1.4
II-319A	Downwind	7.85	5 <	72.1	0.305	1.99 <	0.73	4,582.8	4,580.3	2.5
HH-319A	Downwind	9.90	5 <	70.2	0.334	1.99 <	0.77	4,565.1	4,562.8	2.3

		NH3-N VOLUMES (L)	HCl in air VOLUMES (L)	Metals & TSP VOLUMES (ft^3)	CO Volumes (L)
DD-319A	Upwind	18.216	36.27	3,600	8.9946
EE-319A	Downwind	18.234	36.18	3,600	8.9928
II-319A	Downwind	18.288	36.27	3,600	8.9946
HH-319A	Downwind	18.234	36.27	3,600	8.9946

< - Denotes constituent not detected. Value is the analytical reporting limit.

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 319A - Statistical Evaluation
March 1, 2016

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/m3)		HCl in air (ug/m3)	Al (ug/m3)	Cr (ug/m3)		Pb (ug/m3)	CO (ppm)	TSP (ug/m3)
BURN 319A										
DD-319A	Upwind	286.6	<	137.9	0.64	0.003	<	0.00943	0.57	17.7
EE-319A	Downwind	828.1	<	138.2	0.76	0.003	<	0.00973	0.62	13.8
II-319A	Downwind	429.2	<	137.9	0.71	0.003	<	0.00978	0.73	24.6
HH-319A	Downwind	542.9	<	137.9	0.69	0.003	<	0.00978	0.77	22.6

NOTES:
< = Not detected.

	NH3-N	HCl in air	Al	Cr	Pb	CO	TSP
COUNT:	3	3	3	3	3	3	3
MEAN DOWNWIND CONC.:	600	69.0	0.72	0.00	0.0048	0.707	20.3
STANDARD DEVIATION:	168	0.08	0.03	0.000	0.0000	0.063	4.7
SQRT(N+1/n):	1.15	1.15	1.15	1.15	1.15	1.15	1.15
SAMPLE t VALUE:	1.62	0.61	2.21	0.65	4.6	1.87	0.48
DEGREE OF FREEDOM:	2	2	2	2	2	2	2
CRITICAL t VALUE:	6.965	6.965	6.965	6.965	6.965	6.965	6.965
COMMENTS:	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN

NOTES:
NOT SIGN = Not Significant. Population mean of downwind concentrations likely does not exceed upwind concentrations.
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AEROJET CORP., ORANGE COUNTY FACILITY
Burn 321A - Statistical Evaluation
May 18, 2016

BURN 321A RAW FIELD DATA AND LABORATORY RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/sample)	HCl in air (ug/sample)	Al (ug/sample)	Cr (ug/sample)	Pb (ug/sample)	CO (ppm)	Total Suspended Particulates (TSP) (mg) after	(mg) before	(mg/sample) mass
HH-321A	Upwind	6.42	5 <	92.9	0.343	1.97 <	0.55	4,550.7	4,548.9	1.8
BB-321A	Downwind	4.77	5 <	91.6	0.419	1.99 <	0.56	4,554.6	4,552.3	2.3
CC-321A	Downwind	14.90	5 <	43.0	0.263	1.96 <	0.64	4,558.8	4,557.0	1.8
LL-321A	Downwind	12.60	5 <	77.3	0.334	1.91 <	0.58	4,558.2	4,556.2	2.0

		NH3-N VOLUMES (L)	HCl in air VOLUMES (L)	Metals & TSP VOLUMES (ft^3)	CO Volumes (L)
HH-321A	Upwind	18.216	36.234	3,600	8.9946
BB-321A	Downwind	18.234	36.234	3,600	8.9946
CC-321A	Downwind	18.306	36.270	3,600	8.9946
LL-321A	Downwind	18.234	36.270	3,600	8.9946

< - Denotes constituent not detected. Value is the analytical reporting limit.

AEROJET CORP., ORANGE COUNTY FACILITY
Burn 321A - Statistical Evaluation
May 18, 2016

SAMPLE NUMBER	SAMPLE LOCATION	NH3-N (ug/m3)		HCl in air (ug/m3)	Al (ug/m3)	Cr (ug/m3)		Pb (ug/m3)	CO (ppm)	TSP (ug/m3)
BURN 321A										
HH-321A	Upwind	352.4	<	138.0	0.91	0.003	<	0.00968	0.55	17.7
BB-321A	Downwind	261.6	<	138.0	0.90	0.004	<	0.00978	0.56	22.6
CC-321A	Downwind	813.9	<	137.9	0.42	0.003	<	0.00963	0.64	17.7
LL-321A	Downwind	691.0	<	137.9	0.76	0.003	<	0.00938	0.58	19.6

NOTES:
< = Not detected.

	NH3-N	HCl in air	Al	Cr	Pb	CO	TSP
COUNT:	3	3	3	3	3	3	3
MEAN DOWNWIND CONC.:	589	69.0	0.69	0.00	0.0048	0.593	20.0
STANDARD DEVIATION:	237	0.03	0.20	0.001	0.0002	0.034	2.0
SQRT(N+1/n):	1.15	1.15	1.15	1.15	1.15	1.15	1.15
SAMPLE t VALUE:	0.86	1.22	0.95	0.06	0.2	1.10	0.98
DEGREE OF FREEDOM:	2	2	2	2	2	2	2
CRITICAL t VALUE:	6.965	6.965	6.965	6.965	6.965	6.965	6.965
COMMENTS:	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN	*NOT SIGN	NOT SIGN	NOT SIGN

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